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STAGES OF THE DES MOINES, OR CHIEF COAL-BEARING SERIES OF KANSAS AND SOUTHWEST MISSOURI AND THEIR EQUIVALENTS IN IOWA.

BY CHARLES R. KEYES.

The principal coal-bearing formation of Iowa and other parts of the western interior basin is the lower coal measures, or Des Moines series as it is now termed. Although the formation has been long recognized in practically its present geologic limits it has been only very recently that any attempt has been made to even suggest subdivisions of the series. It is to these minor distinctive parts that have been made out clearly in southwest Missouri and the adjoining portions of Kansas that attention is directed.

Over the whole of its areal extent in the western interior coal field the Des Moines series, or productive coal measures, is clearly limited above by the Bethany limestone and below by the Mississippian limestones, or earlier formations. Until very recently no attempt has been made to subdivide the principal coal-bearing series of the region. Minor divisions have been vaguely recognized, however, in different parts of the area occupied by these rocks. In the southwestern extension of the belt the most definite information in regard to the detailed relations of the various strata has been obtained. In that part of western Missouri south of the Missouri river three stages have been traced out. They are known to extend northeastward into other parts of the state. Since these have been determined very similar lines have been recognized in Kansas, where special names have been applied.* The three stages that are capable of more or less clear demarkation in Missouri and Kansas are the Cherokee shales, at the bottom, the Henrietta limestones, and the Pleasanton shales at the top.

Cherokee Shales.—The term Cherokee as a designation for the lower part of the coal measures was first applied by Haworth

*Univ. Geol. Sur., Kansas, vol. I, p. 150, 1896.

and Kirk.* While it was not formally nor properly defined as a formation name subsequent description† leaves practically no doubt as to its extension. The name had been previously used by Jenney for the lead-bearing formations of the Mississippian series of southwest Missouri but only incidentally, and before it was proposed formally to use the title‡ thus, the term had been appropriated in another sense. Moreover, Cherokee, as applied to the lead-bearing rocks, covers an indefinite sequence of beds for which specific titles that are not well defined have been already adopted, so that even if the term in this sense had been formally suggested it could scarcely be considered as having priority. In this sense also the term has nowhere been accepted as a geological name, while it has been practically refused recognition by all who have had occasion to refer to it, either directly or indirectly.

The Cherokee contains a number of minor formations to which special names are applicable locally. These require no definition. They refer more directly to the coal seams, and thick sandstones.

Henrietta Limestone.—The name Henrietta was used by Marbut§ for a subdivision of the coal measures which gives rise, in southwestern Missouri, to a prominent physiographic feature called the Henrietta escarpment. It consists of several limestone beds of great persistency separated by shales, but presenting a sharp contrast to the underlying and overlying formations which consist of shales and sandstones.

In southeastern Kansas it embraces of Swallows sections‖ essentially numbers 203 to 217, or from the top of the Pawnee limestone down to the cement rock under the Fort Scott limestone. In the more recent references¶ to these beds the same limestones are recognized but the lower bed is termed the Oswego limestone.

The Henrietta formation, in southwestern Missouri and southeastern Kansas at least, is a three fold division, having an upper and a lower limestone separated by shale thirty to fifty feet thick and carrying thin beds of limestone.

To the lower or calcareous number the term Fort Scott limestone is properly applied. This is the name used by Swallow,

*Kansas Univ. Quart, vol. II, p. 105, 1894.
†Univ. Geol. Sur., Kansas, vol. I, p. 150, 1896.
‡Trans. American Inst. Min. Eng., vol. XXII, p. 171, 1894.
§Missouri Geol. Sur., vol. X, p. 44, 1896.
‖Kansas Geol. Sur., Prel. Rep., pp. 24-25, 1866
¶University Geol. Sur., Kansas, vol. I, p. 151, 1896.

whose meaning can be easily defined. More recently another title has been given to practically the same formation, but as the two are essentially coterminous it seems that the earlier of the two can be retained with advantage. The latter term includes only a few layers additional, which are also well exposed at the typical locality. The latter term is Oswego, which, though used previously without definition, was described only very recently.*

The medial shale member may be designated as the Marmaton formation from the stream of the same name in Vernon county, Missouri, and Bourbon county, Kansas, where the shale may be considered as typically developed.

The Pawnee limestone forms the upper member of the Henrietta. The term was first used by Swallow† for a heavily bedded limestone occurring in southeastern Kansas.

Pleasanton Shales.—The name Pleasanton was first applied by Haworth.‡ There is, however, some difficulty in determining just what title is the proper one to use in this connection. Swallow§ seems to have had essentially the same idea in applying to the principal coal-bearing shales immediately overlying the Pawnee limestones in southeastern Kansas, the term "Marais des Cygnes coal series." He, however, appears to have gotten the upper part considerbly mixed, especially the limestones, if later work is to be relied upon. Only the lower half of this coal series can be regarded as forming the equivalent of the Pleasanton, or numbers 194 to 202 of Swallow's section. These beds are typically exposed in Bourbon county, and along the Marais des Cygnes river in Linn county, Kansas, the locality being practically the same as that in which the town of Pleasanton is situated, so that the original localities for both are essentially the same. The "series," however, evidently embraces so much more than it should to form a compact, easily defined formation, and the upper part, moreover, is so far from being correct that it would seem best not to attempt to restrict and redefine the limits of the formation in order to retain the name.

For the strata lying between the Pawnee and Bethany limestones Haworth and Kirk‖ first suggested the name Laneville

*Univ. Geol. Sur., Kansas, vol. I, p. 151, 1896.
†Kansas Geol. Sur., Prelim. Rep., p. 24, 1866.
‡Kansas Univ. Quart., vol. III, p. 274, 1895.
§Kansas Geol. Sur., Prelim. Rep., pp. 22-24, 1866.
‖Kansas Univ. Quart., vol. II, p. 108, 1894.

shales. Had this term been defined in any way it would probably have to be adopted as the designation of the formation. Subsequently Haworth* without the slightest reference to this title, and without a very much better definition for the new name changed it to Pleasanton shales. As in a later publication† the latter term has been more clearly limited and applied, it should probably be regarded as the proper designation of the formation.

In Iowa there are recognizable in the Des Moines series (1) an upper shale bed of considerable thickness, which lies beneath the Bethany or Winterset limestone, (2) a lower shale bed, 300 to 400 feet thick which rests on the Mississippian and older strata, and (3), between the two, a set of beds that includes limestone layers which, though comparatively thin, rarely more than four to six feet, are of relatively great lateral persistency and carry at least one seam of workable coal. In southern Iowa the last mentioned beds appear to be best developed in Appanoose county and the adjoining districts. The Mystic coal, the seam having the greatest areal extent of any in the state, is included in this median member. The limestone beds are closely associated with the coal. The strata have a total thickness of perhaps seventy-five feet. They indicate an epoch, during which temporarily, marine conditions prevailed to a greater extent than during any other time between the secession of Mississippian deposition in the region and the introduction of the Missourian.

The exact relation between these particular subdivision lines of the strata of Iowa and of southwest Missouri have, of course, not been directly traced in detail, but the close resemblance of the vertical sections is so striking and the probabilities of their being equivalent are so great that it seems worth the while, at this time, to call attention to the facts, while the top and bottom of the Des Moines series, as a whole, has been clearly made out over the entire region.

*Kansas Univ. Quart., vol. III, p. 274, 1895
†Univ. Geol. Sur., Kansas, vol. I, p. 153, 1896.